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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/889,078	07/11/2001	Mark Gilbert Benz	RD-25877	7997

7590 08/11/2005

General Electric Company  
CRD Patent Docket Rm 4A59  
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EXAMINER

MCNELIS, KATHLEEN A

ART UNIT	PAPER NUMBER
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1742

DATE MAILED: 08/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/889,078

Applicant(s)

BENZ ET AL.

Examiner

Kathleen A. McNelis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 5/27/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 7-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

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### **CLAIMS STATUS**

Claim 6 was cancelled. Claims 1-5 and 7-17 remain for examination, wherein claims 1, 5 and 7 are amended. Claims 12-17 were not addressed in the first office action, but have been examined and are addressed in the following detailed action.

### **EXAMINER'S COMMENTS**

There appears to be a typographical error on claim number 17: "...a partial pressure of nitrogen in the flux, below the partial pressure of nitrogen in the flux below the partial pressure of nitrogen in the inclusion." Examiner has interpreted this to mean: "...a partial pressure of nitrogen in the flux, below the partial pressure of nitrogen in the inclusion."

### **DETAILED ACTION**

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

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the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-5, 11-12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al. (1994; US 5,332,197) in view of Choudhury et al. (US 5,234,486).

With respect to claims 1-4, Benz et al. (1994) discloses a method for the electroslag refining of titanium base alloys to achieve a low nitrogen content, the slag used will be a slag containing calcium fluoride or similar fluoride conventionally used with a particular titanium base metal in the conventional electroslag refining thereof (col. 6, lines 40-49).

Benz et al. (1994) does not specifically disclose the addition of dissolved calcium metal in the slag composition. Choudhury et al. discloses a method for remelting reactive metals, including titanium, by electroslag remelting in an inert gas atmosphere. In the method disclosed by Choudhury et al., calcium metal is added to purify the reactive metal (titanium) when melted. Choudhury et al. discloses equilibrium equations for the reaction of calcium metal with oxygen to produce CaO, and nitrogen to produce  $\text{Ca}_3\text{N}_2$ , which are then retained by the calcium fluoride slag (col 1. line 31 to col. 2 line 6). It would have been obvious to one of ordinary skill in the art at the time the invention



With respect to amended claim 5, Benz et al. (1994) does not address additions of calcium oxide to the flux. Choudhury et al. discloses that it is beneficial to add calcium oxide to a flux formed of fluorspar (calcium fluoride), because the fluorspar has a low electrical resistance and would require higher power to heat than if calcium oxide is also added. Further, the calcium oxide is not reactive with titanium, and may be used to refine titanium alloys (col. 2, lines 6-17). It would have been obvious to one of ordinary skill in the art at the time the invention was made to add calcium oxides to the flux described in Benz et al. (1994) to reduce the electrical power required for heating, as disclosed in Choudhury et al.

With respect to claims 11 and 12, Benz et al. (1994) teaches that an inert gas, such as helium or argon, is circulated throughout the apparatus (col. 12, lines 56-68). Choudhury et al. discloses that the remelting of reactive metals is done with an inert gas atmosphere over the slag bath (col. 1, lines 27-50) to prevent oxidation, and that argon has proven most advantageous (col.2, lines 15-20). It would have been obvious to one of ordinary skill in the art at the time the invention was made to contain the flux and electrode disclosed in Benz et al. (1994) within an inert atmosphere to prevent oxidation as disclosed in Choudhury et al., and for that gas to be selected from the group of argon, neon, helium, hydrogen or mixtures thereof, since Choudhury et al. indicate that argon is most advantageous to purify reactive metals during remelting.

With respect to product claim 16,<sup>Since</sup> Benz et al. (1994) in view of Choudhury et. al., teaches a process similar to that of instant claim 1, the article made by the instant claim

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1 would not be patentable over the article made by Benz et al. (1994) in view of Choudhury et al.

Amended claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994) in view of Choudhury et. al. as applied to claim 1 above, and in further view of Duckworth, et. al. in "Electro-slag Remelting", pages 47 to 50.

Benz et al. (1994) discloses a method for refining titanium in a calcium fluoride flux, but do not teach the addition of calcium metal to the flux. Choudhury et al. discloses the beneficial addition of calcium metal to the flux for titanium purification, but does not address the quantity of the addition. Duckworth et al. lists metals (including calcium) as minor components that may be added to slag for deoxidation, and discloses a composition of less than 10% for the metal addition (pages 47-50). Duckworth et al.'s disclosed range of less than 10% calcium in the slag overlaps the claimed range of from 1 to 4.5 weight % calcium. It has been well settled that where the applied prior art teaches a range of compositions or properties overlapping a claimed range, motivation to select a particular range or value within the range disclosed by the prior art would have been a modification obvious to one of ordinary skill in the art at the time the invention was made. See MPEP 2144.05. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added calcium to the flux of Benz et al. (1994) to benefit from the removal of reactive oxygen and nitrogen from the flux as disclosed by Choudhury et. al. Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have added to the

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flux used in Benz et. al (1994) in view of Choudhury et al., a calcium metal composition in the flux of between 1 and 4.5%, selected from the range of less than 10% disclosed, because Duckworth et. al. teach that the whole range of addition up to 10% is beneficial for deoxidation.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994; US 5,332,197) in view of Choudhury et al (US 5,234,486) as applied to claim 1 above, and in further view of Curtis et al (US 4,067,734).

Benz et al. does not explicitly disclose treating alpha-beta titanium, but such titanium alloy is conventional as evidenced by Curtis et al which discloses alpha-beta phase titanium alloys with no more than 0.05% nitrogen (col. 17, lines 33-40). It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the Benz et al.(1994) process in view of Choudhury et al., to refine a alpha-beta titanium alloy, as disclosed by Curtis et al.

Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994; US 5,332,197) in view of Choudhury et al (US 5,234,486) as applied to claim 1 above and in further view of Duckworth, et. al.

In the method of Benz et al. (1994), resistance heating is used to melt the titanium electrode, however the operating process temperatures are not disclosed. Duckworth et. al. teaches that in order to melt the metal electrode, the slag must be fully liquid and at a temperature in excess of the liquidus of the metal being melted. The temperature ultimately reached in a slag bath is a function of the resistance of the slag bath and of the current passing through the slag bath (pp.17-18). Choudhury et al.



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discloses that temperatures of above 1600 °C were reached in heating a calcium fluoride/calcium metal slag (col. 1, lines 38-49). The claimed temperatures of "above about 1500 °C" and "above about 1650 °C" overlap with the temperature range of over 1600 °C disclosed by Choudhury et al. as the operating temperature of the high-purity fluorspar slag process. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use resistance heating to reach temperatures of above about 1500 °C or above about 1650 °C to melt the slag used in the Benz et. al. (1994) process in view of Choudhury et al., in order to ensure that the slag was fully liquid and above the liquidus of the metal electrode as taught by Duckworth et. al.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994) in view of Choudhury et. al. as applied to claim 1 above, and in further view of Parsons (US 3,507,968).

Benz et. al (1994) does not specify that stirring occurs in the claimed process, however stirring by induced magnetic field is an inherent property of an electrosag furnace, as described in Parsons (col. 14 lines 60-65), and is beneficial for preventing segregation in the resulting product. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to do nothing to prevent the inherent stirring in the apparatus of Benz et al. (1994) in view of Choudhury et al., thus receiving benefit of a product with superior morphology as disclosed by Parsons.

Claim 14 is rejected as rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994) in view of Choudhury et. al. as applied to claim 1 above.

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Benz et al. (1994) claims a means for maintaining low partial pressure of nitrogen in the flux (col. 14, lines 3-7) and zero partial pressure (col. 14, lines 46 to 48). The claimed range of  $10^{-12}$  to  $10^{-15}$  atmospheres is within the range claimed in Benz et al. (1994) of between zero and "low" partial pressure. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to achieve a partial pressure of nitrogen in the flux of between  $10^{-12}$  to  $10^{-15}$  atmospheres, since Benz et al. (1994) in view of Choudhury et al. indicates that a "low" nitrogen content in the flux is beneficial for removal of nitrogen from titanium.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al (1994) in view of Choudhury et. al. as applied to claim 1 above and in further view of Duckworth et al.

Choudhury et. al. describe a method for titanium purification wherein high purity calcium fluoride slag is used, with calcium metal additive under an inert gas atmosphere to eliminate or minimize the oxygen content in the slag. Choudhury et. al. does not disclose the actual oxygen content of the slag. Duckworth et al. (p. 19) indicates that fluoride slags are "oxygen free." The claimed oxygen partial pressure of between  $10^{-20}$  to  $10^{-25}$  atmospheres is equivalent Duckworth et al.'s use of the term "oxygen free." It would be obvious to one of ordinary skill in the art at the time the invention was made to maintain the partial pressure of oxygen in the range of between  $10^{-20}$  to  $10^{-25}$  atmospheres in the Benz et. al. (1994) apparatus in view of Choudhury et al., as being essentially "oxygen free", thus minimizing the oxidation of the titanium as taught by Choudhury et. al.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Benz et al. (1994; US 5,332,197) in view of Choudhury et al. (US 5,234,486) and in further view of Duckworth et al. and Snow (US 3,469,968).

Benz et al. discloses an electroslag remelting method to refine titanium alloys by heating in a non-oxidizing atmosphere a calcium halide flux (col. 6, lines 40-49). Benz et al. does not state the specific process steps for melting the electrode, however, FIG 2 (see above) shows that the bottom surface of ingot 24 is melted (col. 11, lines 40-46); and that one can control the rate of melting by the level of refining power supplied to the vessel (col. 11 lines 47 to col. 12 line 2), and that the nitrogen present in the refined titanium is minimized (col. 12, lines 8-17). Benz et al. (1994) discloses a method for recirculation and purification of the inert gas while the process is in operation to remove nitrogen (col. 12, lines 18-68). The purpose of the recirculation system is to treat the gas to remove nitrogen, which is described as beneficial as it reduces the partial pressure of nitrogen in the inert gas of the slag (col. 13, lines 1-10). This process will have the effect of maintaining the partial pressure of nitrogen in the flux at a lower partial pressure than in the inclusion.

Benz et al. (1994) does not specifically disclose the addition of calcium metal to the slag. Duckworth et al. lists metals (including calcium) as minor components that may be added to slag for deoxidation, and discloses a composition of less than 10% for the metal addition (pages 47-50). Duckworth et al.'s disclosed range of less than 10% calcium in the slag overlaps the claimed range of from 1 to 4.5 weight % calcium. It would have been obvious to one of ordinary skill in the art at the time the invention was

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made to have used a calcium metal composition in the flux of between 1 and 4.5% in the process disclosed by Benz et al. (1994) in view of Choudhury et. al.; selecting the composition of 1 to 4.5 wt% from the range of less than 10% disclosed by Duckworth et al., because Duckworth et al. teaches that that the whole range of addition is beneficial for deoxidation of the slag.

Benz et al. (1994) does not disclose the operating temperature of the electroslag process. The claimed temperatures of "above about 1600 °C" is the same as the temperature range of over 1600 °C disclosed by Choudhury et al. It would have been obvious to one of ordinary skill in the art at the time the invention was made to heat the flux in the process of Benz et al. (1994) to above 1600 °C as disclosed in Choudhury et al.'s method for titanium purification in order to liquidfy the slag bath and melt the titanium electrode, as taught by Duckworth et al.

Benz et al. (1994) does not specify that alternating current be applied to the electrode, however Snow discloses a method for electroslag melting wherein alternating current is applied to an electrode which then melts under a cover of molten flux. Snow discloses that alternating current is selected over direct current because of faster more efficient melting (col. 2, lines 4-68). It would have been obvious to one of ordinary skill in the art to use alternating current in the method of Benz et al. (1994) in view of Choudhury et al. to achieve faster and more efficient melting of flux and electrode as described in Snow.

### **Response to Arguments**

Applicant's arguments filed on May 25, 2005 with respect to claims 1-11 have been considered but are not persuasive.

With respect to amended claim 1, and claims depending therefrom, two additional references have been cited which specifically relate to the addition of calcium metal to a calcium fluoride flux (slag) for purification of a metal electrode in an electroslog process. Choudhury et al. (US 5,234,486) discloses the benefit of adding calcium metal to the slag in purification of titanium, as the calcium reacts with nitrogen and oxygen and binds them in the slag. Duckworth et al. ("Electro-slag Refining, Chapman and Hall Ltd, first published 1969) discloses the addition of alkali earth metals, including calcium to act as deoxidizers in a slag, and gives an addition range of less than 10%. The reduction of partial pressure is a result of a lower free oxygen and nitrogen in the flux. While Choudhury and Duckworth do not specifically state that the partial pressures of nitrogen and oxygen are reduced, this would be a result of the addition of calcium metal to the slag. It would have been obvious to one of ordinary skill in the art at the time the invention was made to add calcium metal to the flux of Benz et. al. (US 5,332,197) to react with nitrogen and oxygen in the flux, thus producing titanium of higher purity as disclosed in Choudhury.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen A. McNelis whose telephone number is 571-272-3554. The examiner can normally be reached on M-F 8:00 AM to 4:30 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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